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MZB-3 Reset Circuitry Modifications

The reset circuit on the Kemitron MZB-3 pcb is described in the manual for that card. A technical analysis of its design appears satisfactory but when certain programs (not all) are installed in the form of on-board firmware, it is often the case that the computer system does not reset as expected at power up. All subsequent operations of the reset button are perfectly as expected, and anyone affected has generally not thought to give the matter any further attention.

However we were very curious to know what was the reason for this strange behavious and have carried out a few experiments and have devised a few minor modifications for users to try if they wish.

Firstly, although the behaviour is only exhibited when certain software is in use, we have disregarded incorrect software as a cause (because it always behaves perfectly when the manual reset function is employed).

Also we observed that the behaviour varied according to the characteristics of the computer power supply. If this was of a type which has a slow rise time (ie the dc voltages build up gradually from zero) the power on reset is less likely to work first time.

At power on capacitor C5 (MZB-3 Manual page 34) holds pin 2 of IC14a low for what appears to be a sufficiently long time (the Z80 reset pin only needs to be held low for 3 clock cycles according to the Z80A-CPU data sheet).

However changing the value of C5 to 47uF has in all our experiments had the desired effect of allowing the power on reset to behave as expected, like any other subsequent reset. Therefore we recommend this as a modification if your own system does not reset properly at power on.

Although this is a modification which does seem to work, it is hard to explain why it does, because as stated before, the power on reset pulse is already well over the required 3 clock cycle minimum the Z80A requires. Our theory is that the crystal clock oscillator takes some time to build up its oscillations and time must be allowed for this. We are talking about very small times here, so the effect would not be displayed on a normal oscilloscope, the crystal oscillator appears to start at once. However we hope to have a report soon from someone who has access to a good storage oscilloscope and is willing to carry out the necessary experiment to see if our theory is correct.

Whilst you are at it, you can (if you wish) change the value of C7 from its present value of 2n2 to one ten times bigger, namely 22n. The purpose of this is to increase the normal reset pulse generated by monostable IC16 (74LS122) from about 8us to 80us. This is to suit the requirements of the 2797 floppy disk controller chip which may be added on the FDC-1 board, if you are likely to use floppy disks. The 2797 data sheet demands a minimum reset pulse width of 50us, although this has hitherto caused no difficulty (possibly because our FDC-1 design has its own on-board power on reset circuit of more than adequate duration).

A final modification to the reset circuit, but with effect so minor as to be hardly worth bothering, is to add a diode 1N 4002 in parallel with resistor R8, the cathode end of the diode to end 1 of the resistor, ie the end connected to +5V. Any 1N 4001-4007 diode will do, the 1N 4148 is a less favoured choice because it only can handle relatively small (less than 1 Amp surge) currents. The purpose of the diode across R8 is to ensure that should the power be removed even for a very short while C5 is discharged much quicker than it would be without the diode; therefore the "power-on-reset" action of C5 will take place correctly, even if power is restored quite quickly. This modification will only be of benefit to those who are regularly switching their computer off and on (such as in fault finding or testing. Whether or not you find it worth doing is up to you; we suggest that you not bother with adding a diode unless the need is apparent. (All of our own similar designs include a diode in this position as a matter of course, so the question does not arise when you are building a card we have designed.)

Summary of components discussed, and suggested modifications

1. Change value of C5 to 47uF. Component required: 47uF miniature radial aluminium electrolytic. Purpose of modification: to delay power on reset operation so that Z80A microprocessor always resets correctly at power on.

2. Change value of C7 to 22nF. Component required: 22nF miniature radial ceramic capacitor. Purpose of modification: to extend manual reset pulse to greater than 50us, to suit the needs of a 2797 floppy disk controller chip which may be fitted elsewhere in the system.

3. Add diode in parallel with R8; cathode to R8 end 1 (+5V rail), anode to R8 end 2 (IC14a pin2). Component required: 1N 4002 or similar. Purpose of modification: to ensure that power on reset circuit takes effect even if power has been removed only for a short time.

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